USDA Natural Resources Conservation Service

Ecological site F103XY031MN
Sandy Floodplains

Last updated: 10/04/2023
Accessed: 05/04/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 103X–Central Iowa and Minnesota Till Prairies

MLRA 103 is in Minnesota (56 percent) and Iowa (44 percent) and consists of approximately 18 million acres. It is in the Western Lake Section of the Central Lowland Province of the Interior Plains in an area known as the "Des Moines Lobe" of the Wisconsin-age ice sheet. The MLRA is mostly on a young, nearly level to gently rolling, glaciated till plain that has moraines and glacial lake plains in some areas. The plain is covered with glacial till, outwash, and glacial lake deposits. Recent alluvium consisting of clay, silt, sand, and gravel fill the bottoms of most of the major river valleys. Paleozoic bedrock sediments, primarily shale and limestone, underlie the glacial deposits in most of the area.

The annual precipitation increases from northwest to southeast. Most of the rainfall occurs as high-intensity, convective thunderstorms during the summer. Two-thirds or more of the precipitation falls during the freeze-free period. Snowfall is common in winter. Ground water supplies are adequate for the domestic, livestock, municipal, and industrial needs. Nearly all of this area is farmland, and about four-fifths is cropland.

Classification relationships

Major Land Resource Area (MLRA): Central Iowa and Minnesota Till Prairies (103) (USDA Handbook 296, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Upper Minnesota River-Des Moines Lobe (251BA) and Southern Des Moines Lobe (251Be) Subsections (Cleland et al. 2007)

International Vegetation Classification Hierarchy
Class: 1. Forest & Woodland
Subclass: 1.B. Temperate & Boreal Forest & Woodland
Formation: 1.B.3. Temperate Flooded & Swamp Forest
Division: 1.B.3.Na. Eastern North American-Great Plains Flooded & Swamp Forest

The reference state shares similarities to Minnesota Department of Natural Resources FFs59 Southern Terrace Forest

Ecological site concept

The Sandy Floodplains ecological site is predominantly located on floodplains of larger rivers throughout MLRA 103. The site is influenced by the hydrologic interaction with the adjacent river which influences the depth to soil saturation. This ecological site may exhibit various plant community composition depending on flooding.

Associated sites

F103XY032MN	**Loamy Floodplains** The Loamy Floodplains ecological site is located on medium textured alluvium throughout MLRA 103. Soil textures include loam, silt loam, sandy loam, and fine sandy loam. Soils are somewhat poorly drained to moderately well drained. Some areas within this ecological site will exhibit long-term flooding (7-30 days).
R103XY003MN	**Sandy Upland Prairies** The Sandy Upland Prairie ecological site is located on uplands including outwash plains and valley trains along modern river valleys. Soils are formed from sandy and course loamy outwash and loamy-mantled outwash. Sites do not flood or pond.
F103XY033MN	**Wet Floodplains** The Wet Floodplains ecological site occurs in both floodplains and depressions and is extensive throughout MLRA 103. Soils include both Mollisols and Entisols, and soil drainage class is very poorly drained to poorly drained. Areas within this site flood frequently, and some areas may incur very long periods of flooding (over 30 days).
R103XY006MN	**Bedrock Controlled Upland Prairies** The Bedrock Controlled Upland Prairies ecological site is characterized by shallow to moderately deep soils that are influenced by bedrock and have a low available water capacity.

Similar sites

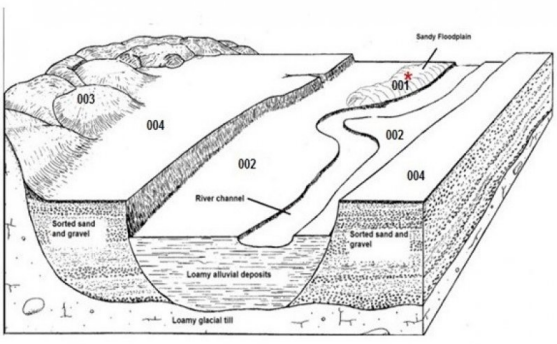
F103XY032MN	**Loamy Floodplains** The Loamy Floodplains ecological site is located on medium textured alluvium throughout MLRA 103. Soil textures include loam, silt loam, sandy loam, and fine sandy loam. Some areas within this ecological site will exhibit long-term flooding (7-30 days).

Table 1. Dominant plant species

Tree	(1) *Ulmus americana* (2) *Fraxinus*
Shrub	Not specified
Herbaceous	(1) *Laportea canadensis*

Physiographic features

The Sandy Floodplains ecological site is located on floodplains of larger rivers in both Minnesota and Iowa portions of MLRA 103. The site is influenced by a hydrologic relationship with the adjacent river, as soil saturation depth fluctuates depending on river water levels. Due to human influences, current flooding regimes are generally reduced from historic levels. Today, areas within this ecological site do not regularly flood, while some sites still flooding. Plant community differences on this site will occur due in response to differences in the frequency, duration, and depth of flooding.



Code	Ecological Site Name	Representative Soil Series
001	Sandy Floodplain	Zumbro, Buckney
002	Loamy Floodplain	Spillville, Du Page
003	Loamy Upland Prairie	Clarion, Nicollet
004	Sandy Upland Prairie	Estherville, Dickinson

Figure 1. Block diagrams of the representative Sandy Floodplains and

associated ecological sites.

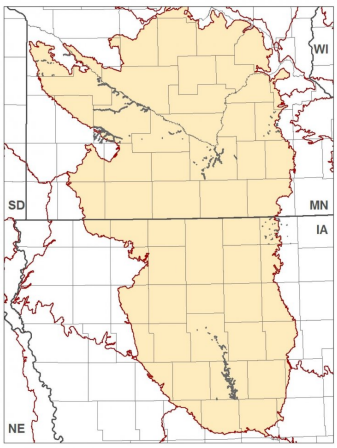


Figure 2. Distribution of the Sandy Floodplains ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Summit (3) Shoulder
Landforms	(1) Flood plain
Runoff class	Negligible to medium
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days)
Elevation	689–1,837 ft
Slope	0–5%
Water table depth	6–80 in
Aspect	Aspect is not a significant factor

Climatic features

The soil temperature regime of MLRA 103 is classified as “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The average freeze-free period of this site is 156 days, while the frost-free period is 127 days. The average mean annual precipitation is 36 inches, which includes rainfall plus the water equivalent from snowfall. Cold air drainage and the fact that wet soils are generally colder than dry soils make this site colder than adjacent, upslope ecological sites. As a result, snow and frost remain longer in the spring, thus resulting in shorter growing seasons than the adjacent uplands.

Table 3. Representative climatic features

Frost-free period (characteristic range)	126-128 days
Freeze-free period (characteristic range)	151-160 days
Precipitation total (characteristic range)	35-37 in
Frost-free period (actual range)	126-128 days
Freeze-free period (actual range)	149-162 days
Precipitation total (actual range)	34-38 in
Frost-free period (average)	127 days
Freeze-free period (average)	156 days

Precipitation total (average)	36 in

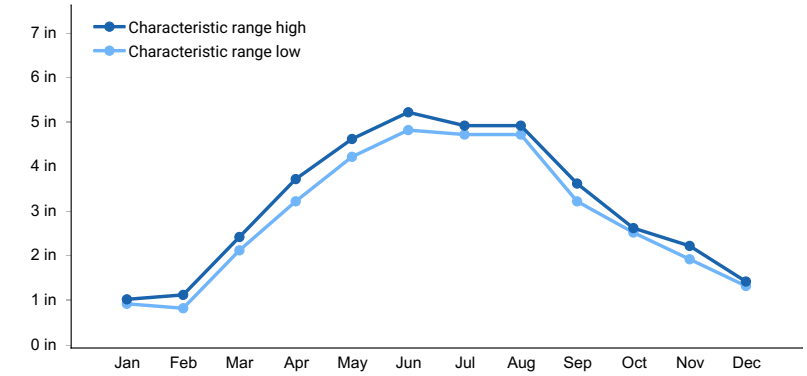


Figure 3. Monthly precipitation range

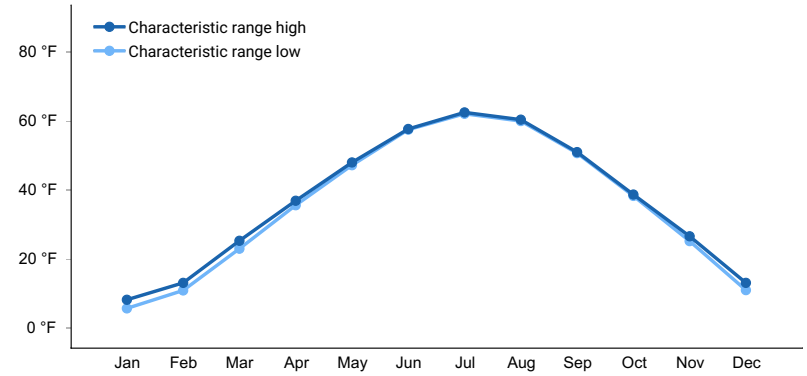


Figure 4. Monthly minimum temperature range

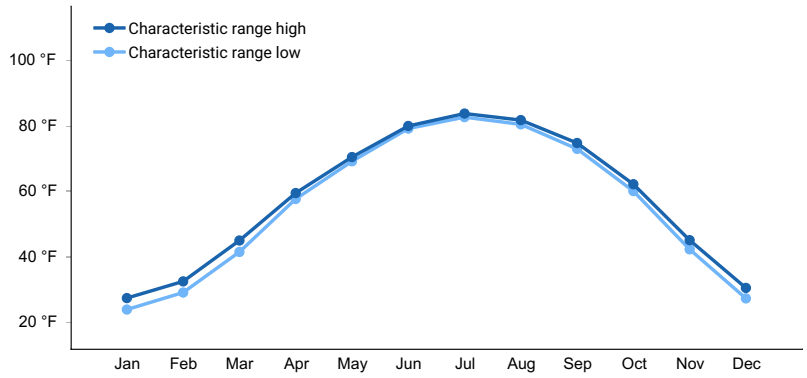


Figure 5. Monthly maximum temperature range

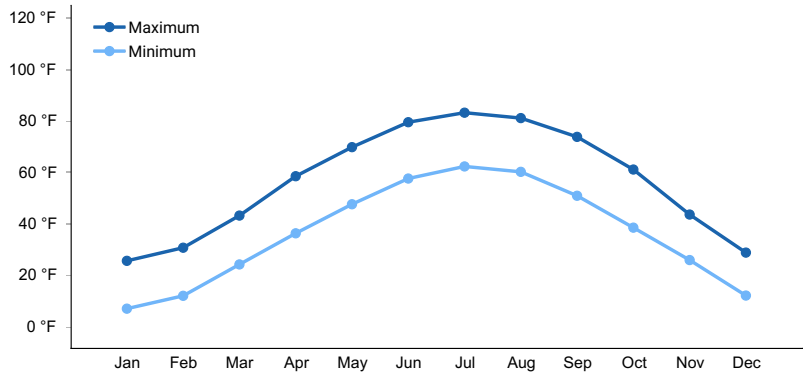


Figure 6. Monthly average minimum and maximum temperature

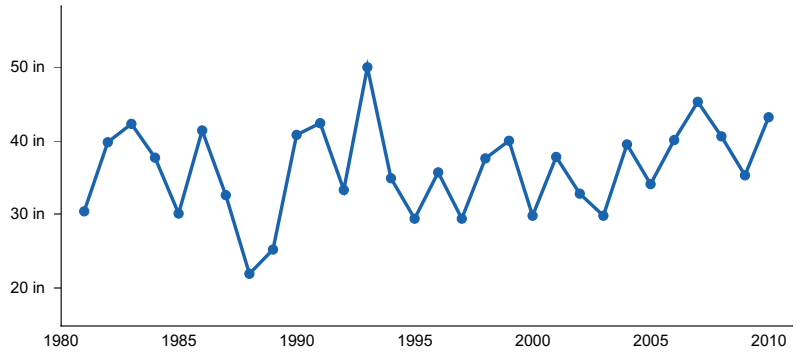


Figure 7. Annual precipitation pattern

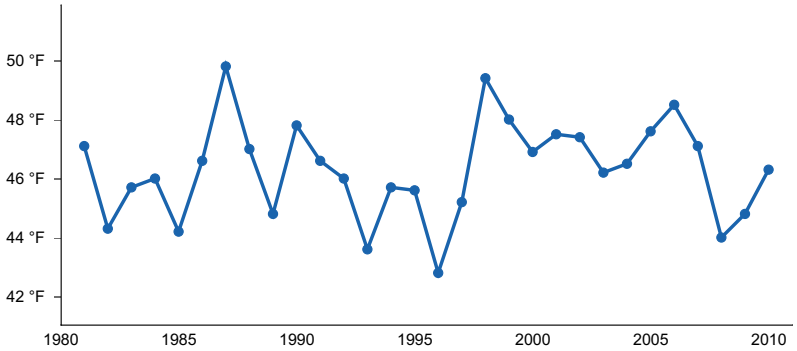


Figure 8. Annual average temperature pattern

Climate stations used

- (1) OWATONNA [USC00216287], Owatonna, MN
- (2) BOONE [USC00130807], Boone, IA

Influencing water features

The important water feature of the Sandy Floodplains ecological site is the hydrological relationship this site has with the adjacent river or stream. Soils are classified as endosaturated. The water table can be as high as 6 inches from the surface during wetter periods, but is typically at or below 40 inches. During the wet months, areas within this ecological site may flood or pond.

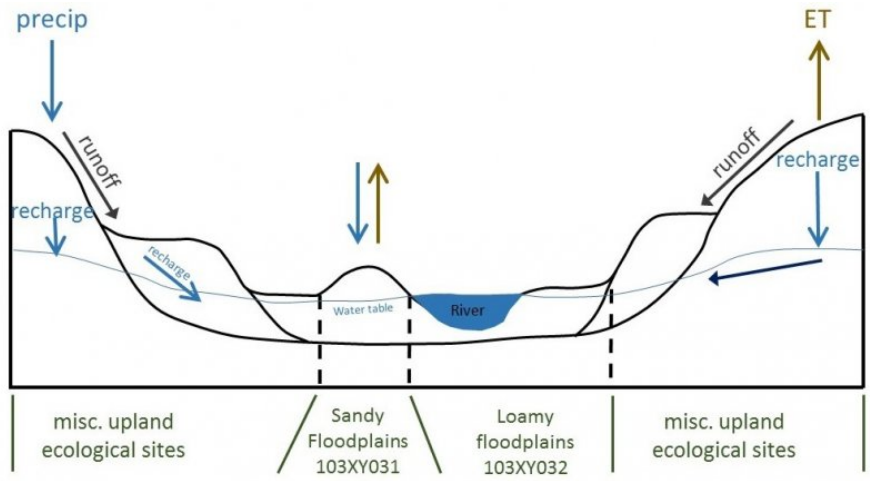


Figure 9. Representation of hydrologic factors in a typical area of Sandy Floodplains and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

The Sandy Floodplains ecological site is located predominately on Buckney, Flagler, Minneopa and Zumbro soil series. The soil parent material is alluvium. The surface texture is fine sandy loam, sandy loam, loamy fine sand, or loamy sand. Fine sandy loam is the dominant surface texture. Soils are classified as Mollisols since they have a thick, dark layer. This dark layer is due to slope wash and alluvial deposition rather than development under prairie vegetation. The soil drainage class can be moderately well drained, well drained, somewhat excessively drained, or excessively drained. Available water capacity is 3-6 inches.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Fine sandy loam (2) Sandy loam (3) Loamy fine sand (4) Loamy sand
Family particle size	(1) Coarse-loamy (2) Sandy
Drainage class	Moderately well drained to excessively drained
Permeability class	Moderately rapid to very rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	3–6 in
Calcium carbonate equivalent (0-40in)	0–30%
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (0-40in)	0–30%
Subsurface fragment volume >3" (0-40in)	0–1%

Ecological dynamics

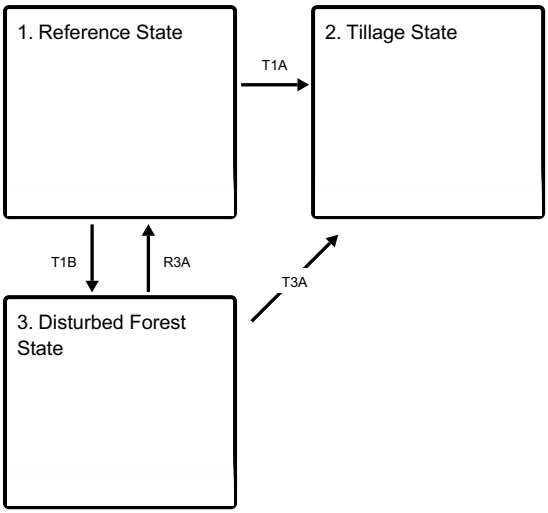
The Sandy Floodplains ecological site is influenced by fluctuating river and stream levels. Some areas within this ecological site incur flooding and ponding. Historically, this site was a mature, hardwood forest community that was compositionally and structurally diverse due to variations in the natural flooding regime. The typical vegetation community was a deciduous riverine forest in various stages of successional development.

The Sandy Floodplains ecological site has three states: the Reference State, the Disturbed Forest State, and the Tillage State.The Reference State is a mature deciduous forest with multiple canopy species and a diverse herbaceous ground layer. This ecological site can be affected by multiple natural triggers (disturbance processes) including flooding, fire, insects, and windstorms. The Tillage State is characterized by tillage and agricultural production. The two communities under this state are the Row Crop Community and the Seeded Grassland Community. Management inputs include preparing the site, seeding, fertilizing, controlling weeds and brush, and harvesting. The Disturbed Forest State is a wooded site that has undergone plant community changes due to human disturbance. Triggers include hydrological modifications, logging/clearing, invasive plants, and unmanaged grazing.

Today, most areas of this ecological site have been cleared and converted to agriculture. Site hydrology has been altered through ditching, tiling, site clearing, industrial and residential water use, and/or installation of flood control structures within the watershed. Sites that remain wooded have usually been disturbed through logging, previous clearing, or introduction of non-native plants. Once a high-quality reference state has been transitioned to a tillage field, the reversibility class is considered irreversible.

State and transition model

Ecosystem states



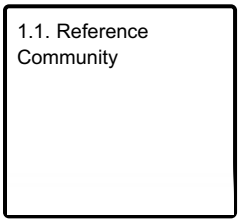
T1A - Site is cleared, tilled, seeded, and managed for crop production

T1B - Site incurs large-scale disturbance and altered plant community

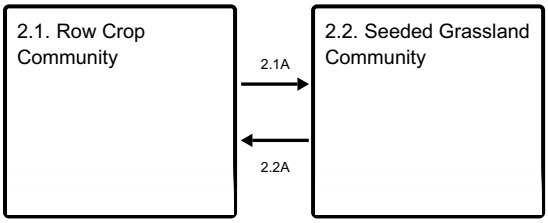
R3A - Restoration of natural hydrology; establishment of desired species; exclusion of anthropogenic disturbances; eradication of invasive species; long-term timber stand management

T3A - Site cleared, soil tillage, crop establishment, and continued agriculture management

State 1 submodel, plant communities



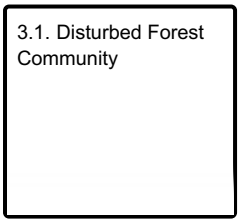
State 2 submodel, plant communities



2.1A - Seeding and management of warm or cool season grasses.

2.2A - Site preparation, soil tillage, crop establishment, weed control

State 3 submodel, plant communities



State 1
Reference State

The reference state is composed of multiple canopy species including American elm, slipery elm, green ash, and

black ash. Minor components often include basswood, silver maple, and hackberry. The composition of early successional communities will be variable depending on seed sources and the severity of the disturbance. Early successional dominants commonly include American elm, slippery elm, American basswood, and willows. Mid-successional dominants include American elm, slippery elm, green ash, and black ash. (MN DNR, FFs59). Cottonwood is often a component of early stage communities. The understory community composition will vary depending upon the hydrology and flooding regime of the site.

Resilience management. Resilience management practices include monitoring and treating for invasive vegetation.

Dominant plant species

- American elm (*Ulmus americana*), tree
- ash (*Fraxinus*), tree
- Missouri gooseberry (*Ribes missouriense*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

Community 1.1
Reference Community

The Reference Community is characterized by multiple canopy species, a sparse shrub layer, and a variable ground cover of native herbaceous species. Tree species on this site include American elm, green ash, slippery elm, black ash, and other hardwoods. The hydrology will influence species composition on these sites. Successional communities will vary depending on age, severity of disturbance, and seed sources. Shrub density may be sparse depending on flooding regime, and species will be influenced by the hydrological characteristics of each site.

Resilience management. Resilience management practices include monitoring for invasive vegetation, applying weed control methods as needed, and excluding other anthropogenic disturbances.

Dominant plant species

- American elm (*Ulmus americana*), tree
- ash (*Fraxinus*), tree
- Missouri gooseberry (*Ribes missouriense*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

State 2
Tillage State

The Tillage State contains the Row Crop Community and the Seeded Grassland Community. This state describes areas currently in crop production or areas that were tilled but now are seeded to grass. Pathway mechanisms include preparing the site, planting desired species, applying herbicide, applying fertilizer, and harvesting. Hydrological modifications (tiling and ditching) may be installed to improve drainage. Soil tillage is the primary trigger to State 2. Tillage alters dynamic soil properties, including bulk density, structure, organic carbon content, and saturated hydraulic conductivity. Intensive tillage negatively impacts soil ecological functions. Conservation practices help mediate soil health impacts. Conservation tillage minimizes soil disturbance and improves soil structure and soil health. A cover crop rotation builds soil structure, improves infiltration rates, reduces runoff and erosion, and protects water quality. A few areas within this ecological site may have been converted to a grasses. Species will depend on specific site characteristics and landowner objectives. Seeded grasslands do offer some ecological benefits to wildlife, water quality, and soil health.

Dominant plant species

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

Community 2.1
Row Crop Community

Community 2.1 consists of intensive row crop agriculture. Soil tillage and intentional plant establishment are the primary triggers. The most common crops are corn and soybeans on an annual rotation. Many crops, however, are feasible for these areas. A secondary trigger may be drainage modifications (ditching and tiling). Conservation tillage practices may be implemented to reduce soil erosion while still maintaining a crop rotation. Additional soil health benefits can be gained by adding alternative crops to fields that are already in conservation tillage. By diversifying the crop rotation, landowners take additional management steps to improve soil health and protect water quality.

Resilience management. Resilience management practices include preparing the sites, planting, fertilizing, controlling weeds, and harvesting. The maintenance of the desired vegetation community is controlled by the intensity, frequency, duration, and timing of agricultural practices.

Dominant plant species

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

Community 2.2
Seeded Grassland Community

The Seeded Grassland Community grows in areas that were previously tilled and used for row crop production, but have been transitioned to warm-season or cool-season grasses. The primary trigger is the intentional establishment of a grass species. Seed mix selection depends on landowner objectives and site-specific characteristics. Management inputs include seeding, fertilizing, and controlling weeds and brush. Resilience management practices include invasive plant management and a program of planned grazing. Many of these areas are eventually transitioned to annual crop production.

Resilience management. The resilience management practices may include planting desired species, managing grazing, mowing, fertilizing, and controlling unpalatable plant species. Prescribed fire is a resilience management practice for warm-season grasslands. The controlled application of fire modifies vegetation structure and influence ecological processes.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Pathway 2.1A
Community 2.1 to 2.2

This pathway converts Community 2.1 (row crops) to Community 2.2 (seeded grassland). The primary mechanism of change is the seeding of desired grass species. Multiple resilience management practices may be utilized after grass establishment. Examples include brush management and herbaceous weed treatment.

Conservation practices

Conservation Cover
Range Planting

Pathway 2.2A
Community 2.2 to 2.1

This pathway describes the site transitioning from a seeded grassland to row crop agriculture. The mechanisms of change are tillage and intentional plant establishment (crop seeding). Resilience management practices include weed control (herbicide application), disturbance management (field cultivating), and harvest management.

State 3

Disturbed Forest State

This state describes a wooded site that has been disturbed and exhibits altered species composition. Site disturbance may include altered hydrology, selective tree removal, site clearing, or invasive species. Numerous ruderal woodland and forest plant communities may occur on this ecological site depending on the type and severity of disturbance, the successional stage of the plant community, available seed sources, and management activities.

Dominant plant species

- elm (*Ulmus*), tree
- ash (*Fraxinus*), tree
- eastern cottonwood (*Populus deltoides*), tree
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- creeping charlie (*Pilea nummulariifolia*), other herbaceous

Community 3.1
Disturbed Forest Community

Community 3.1 is an altered forest community caused by substantial disturbance. Invasive species are common in this community. Canopy composition varies depending on the severity and type of disturbances, community age, and the availability of seed sources. Invasive, non-native species are common on these sites and will continue to increase without management intervention.

Dominant plant species

- elm (*Ulmus*), tree
- ash (*Fraxinus*), tree
- eastern cottonwood (*Populus deltoides*), tree
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass
- creeping charlie (*Pilea nummulariifolia*), other herbaceous

Transition T1A
State 1 to 2

Transition T1A is the conversion of the Reference State to agriculture. The triggers are site clearing, soil tillage. and intentional plant establishment (crop seeding). Resilience management practices include common agricultural practices such as seeding, fertilizing, and managing invasive plants with herbicides or field cultivation. Hydrological modifications, such as ditching and tiling, may be present.

Constraints to recovery. Site clearing and soil tillage preclude recovery of the former state.

Transition T1B
State 1 to 3

Transition T1B is a transition from a mature deciduous forest to a disturbed (ruderal) forest. Triggers include timber harvest, surface site disturbance, grazing, and introduction of non-native species. The native plant community is altered, and these areas do not exhibit the ecological function or vegetative composition of State 1.

Restoration pathway R3A
State 3 to 1

Restoration to the Reference State may be feasible for some sites with long-term management inputs including restoration of natural hydrology, establishment of desired species, forest stand management (selective thinning), and control of invasive species. Triggers include intentional plant establishment (planting desired species), absence of disturbance (site protected from grazing and other site altering disturbances), timber stand improvement inputs, and eradication of invasive plant species. Ditching and tiling may be present on site altering the natural hydrology.

Conservation practices

Brush Management
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Forest Stand Improvement

Transition T3A
State 3 to 2

Transition T3A is the transition of a disturbed forest state to agriculture production. This is a common pathway in MLRA 103. The mechanisms of change include timber harvest, site preparation, tillage, and intentional plant establishment (crop seeding). Continued resilience management practices are necessary and include weed control (herbicide application), disturbance management (field cultivating), and harvest management.

Constraints to recovery. Soils tillage and the transition to agriculture preclude recovery of the former state.

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

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Contributors

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Approval

Suzanne Mayne-Kinney, 10/04/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be

known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/04/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be**

mistaken for compaction on this site):

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
